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NEW SPECIES OF MITRIDAE, COSTELLARIIDAE AND TURRIDAE FROM THE HAWAIIAN ISLANDS WITH NOTES ON *MITRA SPHONI* IN THE GALAPAGOS ISLANDS

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ABSTRACT

Two new species of Costellariidae, i.e. Vexillum (Costellaria) wolfei sp. nov., and V. (C.) adamsianum sp. nov., a new mitrid Neocancilla kayae sp. nov., and a new turrid Mitrolumna salisburyi sp. nov., are described from deeper water in the Hawaiian Islands. The previously reported occurrence of Mitra sphoni Shasky & Campbell, in the Galapagos Islands is here confirmed and documented by an illustrated specimen; the species is re-assigned to Mitra (Nebularia).

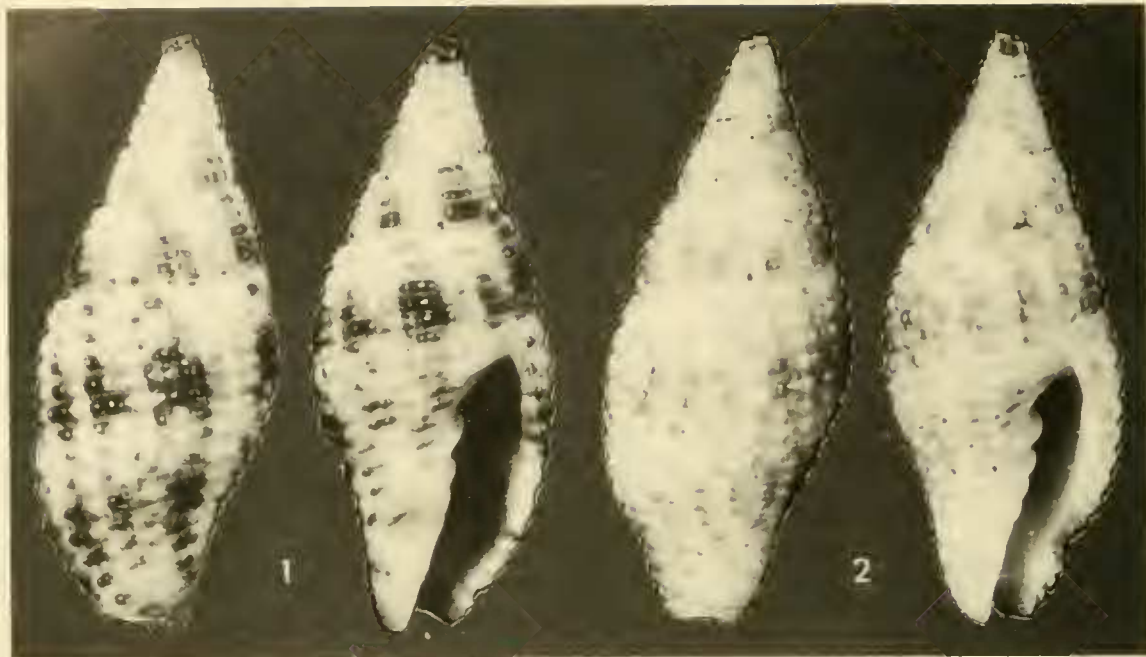
Family Mitridae

Neocancilla kayae new species

(Figs. 1, 2)

Description—Shell moderately small, 8.0-14.0 mm in length, elongate-ovate and stumper than other species of the genus, width about 40-43% of length, protoconch incomplete but multispiral and consisting of 3+ smooth, glassy embryonic whorls, teleoconch consisting of 5-6 almost flat-sided, mature whorls, sutures deeply incised. First

1-3 post-embryonic whorls sculptured with deep vertical and horizontal grooves which produce 3 spiral rows of laterally or vertically elongated nodules, fourth whorl with 4 rows of nodules, penultimate whorl with 5 rows and body whorl with 11-14 rows of nodules and 8-9 smoother and oblique cords basally; on the last two whorls the nodules are regular, elevated and round, close-set and sometimes touching each other and connected to each other both laterally and vertically; the



FIGS. 1, 2. *Neocancilla kayae* new species. 1. Holotype, length 8.7 mm. 2. Paratype, length 13.5 mm.

interspaces are deep and the nodules are regularly aligned in both directions. Aperture slightly longer than the spire, narrow and smooth within, outer lip convex, columella with 4 strong, oblique folds which decrease in size anteriorly; siphonal canal straight, siphonal notch deep. White in colour, ornamented with reddish brown streaks which are saturated in blotches, occasional nodule coloured reddish brown, aperture creamy-white and with an indication of 2 orange-brown zones.

Measurements (mm)

	length	width
Holotype (AIM/TM-1355)	8.7	3.5
Paratypes:		
No. 1 (Auck. Ins. Mus.)	13.5	5.8
No. 2 (coll. Salisbury)	12.0	5.0

Material—HOLOTYPE and type locality: Pokai Bay, Oahu, Hawaiian Ids., 60-70 fathoms; AIM/TM-1355. PARATYPES: No. 1—Pokai Bay, Oahu, H.I., 100 fathoms; AIM. No.'s 2-3—same locality as No. 1; coll. R. Salisbury.

Range—Apparently endemic to the Hawaiian Islands, 60-100 fathoms, in mud and sand or sand and coralline algae.

Remarks—This species differs from all other *Neocancilla* species in the deeply incised sutures

and regular rows of round, close-set nodules. *N. papilio* (Link), has a complicated sculpture of alternating larger and smaller, low fillets which appear stepped in profile and numerous, shallow longitudinal grooves and filleted narrow spiral cords. The sculpture in *N. clathrus* (Gmelin) and *N. arenacea* (Dunker) is of similar style to *N. papilio* and also consists of alternating low, quadrate fillets with laterally elongate fillets in between, and numerous longitudinal grooves.

The new species is only tentatively assigned to *Neocancilla* until the radula is examined. The species is named for Dr. Alison Kay, University of Hawaii, for her valuable research contributions to Hawaiian and Polynesian malacology.

Mitra (*Nebularia*) *sphoni* Shasky & Campbell, 1964

(Fig. 3)

- 1964 *Mitra* (*Strigatella*) *sphoni* Shasky & Campbell. *The Veliger*, vol. 7, no. 2, p. 118, pl. 22, figs. 13, 14.
- 1971 *Mitra* (*Strigatella*) *sphoni* Shasky & Campbell, Keen, *Sea Shells Tropical west America*, ed. 2, p. 612, fig. 1428.
- 1976 *Subcancilla sphoni* (Shasky & Campbell), *Sphon*, *The Nautilus*, vol. 90, no. 2, p. 63.
- 1976 *Mitra* (*Nebularia*) *sphoni* Shasky & Campbell, Cernohorsky, *Indo-Pacific Moll.* vol. 3, no. 17, p. 452, pl. 401.

Sphon (1976) reported a range-extension for this species, (which originally has been described from Guaymas, Mexico) to the Galapagos Islands. This range extension is confirmed by another specimen dredged in 40 metres by the "Foxtrot" Expedition between Isla Barbara and Isla Santa Cruz, Galapagos, in May 1974. This Galapagan specimen has somewhat deeper longitudinal troughs which give rise to weak axial folds on the body whorl, and the interspaces of the spiral cords are obsoletely lirate.

We agree with Sphon (*op. cit.*) that the original placement of the species in the mitrid subgenus *Strigatella* Swainson, was inappropriate, since *Strigatella* species show a consistent feature of a posteriorly thickened outer lip, which frequently takes the form of a blunt denticle. However, Sphon's placement of *sphoni* in the genus *Subcancilla* Olsson & Harbison, is equally inappropriate since *sphoni* lacks the characteristic features of that genus. *Mitra sphoni* is closely related to the west American *M. crenata* Broderip, and is conchologically extremely similar to such Indo-Pacific *Nebularia* species as *M. proscissa* Reeve, *M. fraga* Quoy & Gaimard, *M. rubritincta* Reeve, and several others whose radulae are known to be of the *Mitra* type. It is

my opinion that once the radulae of *M. crenata* and *M. sphoni* are examined, they will prove to be of the mitrine type.

Family Costellariidae Macdonald, 1860

The chronologically prior family-group name Costellariidae Macdonald, 1860, will have to replace Vexillidae Thiele, 1929. For further discussion on this subject see Cernohorsky (1976).

Vexillum (Costellaria) wolfei new species

(Figs. 4, 5)

Description—Shell very small, 5.0-10.0 mm in length, elongate-ovate, width 38-42% of length, shining, protoconch conical-multispiral, consisting

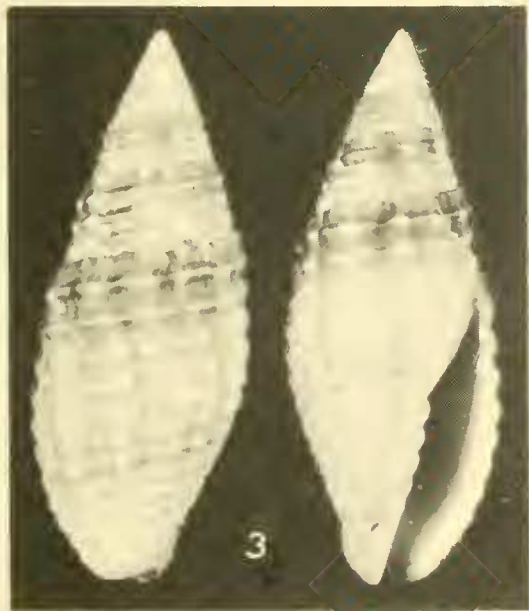


FIG. 3. *Mitra (Nebularia) sphoni* Shasky & Campbell; specimen from the Galapagos, Ids., length 25.6 mm.



FIGS. 4, 5. *Vexillum (Costellaria) wolfei* new species. 4. Holotype, length 6.3 mm. 5. Paratype, length 6.6 mm.

of 3¹/₄-3³/₄ glassy, embryonic whorls which are either straight or tilted, teleoconch consisting of 5-6 convex, mature whorls. Sculptured with slender and thin axial ribs which produce a row of sutural nodules and number from 12-17 on the penultimate and 14-17 on the body whorls; spiral sculpture consists of narrow, flattish spiral cords which only ascend the wall of the ribs rendering these imperceptibly nodulose; spiral threads number from 5-7 on the penultimate and from 10-12 on the body whorl, base of shell with 3 or 4 nodulose cords followed by 3 or 4 smoother cords. Aperture slightly shorter than the spire, height 42-47% of length, lirate within, outer lip convex, columella only weakly calloused and with 3 or 4 prominent, oblique folds which decrease in size anteriorly. Base colour white, frequently with a translucent golden sheen, 4 spiral cords anteriorly to the sutures and 4 cords at the base of the body whorl lined with reddish brown and giving the impression of a broad central band, interspaces of sutural nodules usually spotted with reddish brown in mature individuals; aperture white and lined with reddish brown; columella white.

Measurements (mm)

	length	width
Holotype (AIM/TM-1348)	6.3	2.5
Paratypes:		
No. 1 (DMNH 112103)	6.0	2.2
No. 2 (BPBM)	7.0	2.7

Material—HOLOTYPE: Pokai Bay, Oahu, Hawaiian Ids., 60-70 fathoms; AIM/TM-1348. PARATYPES: No. 1—same data as the holotype; DMNH 112103. No. 2.—same data as the holotype; BPBM. No. 3—Keehi Lagoon, Oahu, H.I.; 100 fathoms; Salisbury coll. Nos. 4-24—same data as the holotype; AIM and other institutions and collections.

Range—Apparently endemic to the Hawaiian Islands, 60-100 fathoms.

Remarks—*V. (C.) wolfei* can be compared with the moderately common intertidal and subtidal Indo-Pacific species, *V. (C.) amanda* (Reeve, 1845), but the latter species is somewhat larger, considerably more solid with a duller surface and more slender sutural nodules which are usually

the same width as the ribs, and more numerous, finer and thinner spiral threads. *V. (C.) amanda* has a continuous dark-brown sutural band on the spire whorls and 2 or 3 dark-brown bands on the body whorl, and lacks the reddish brown-lined cords, as well as the translucent sheen of *V. (C.) wolfei*.

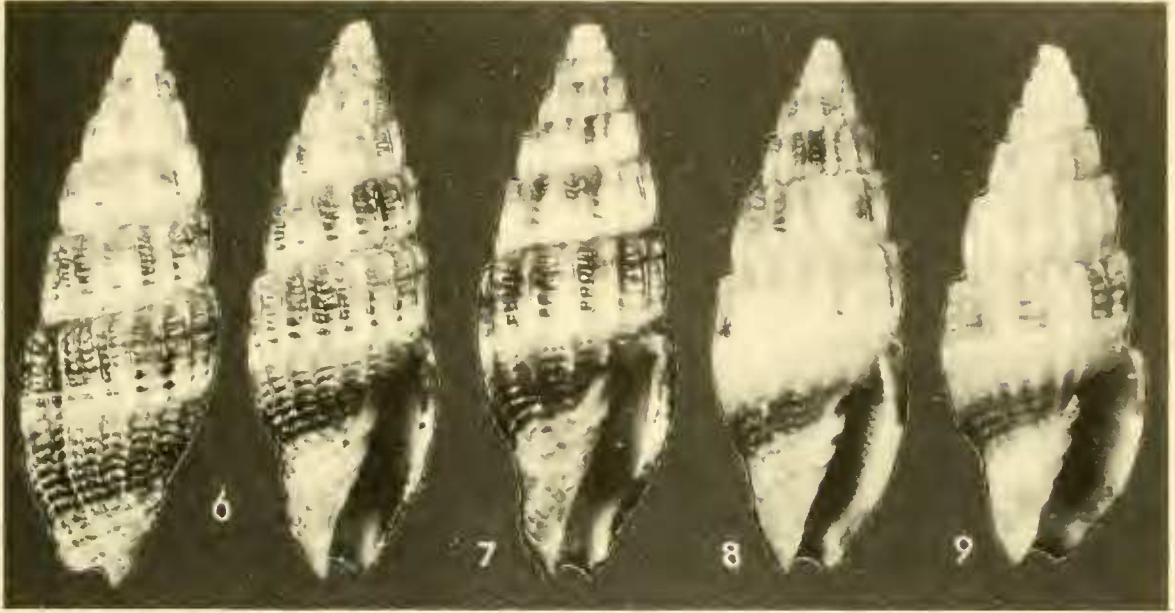
This new species is named for Mr. C. S. Wolfe, Honolulu, in appreciation for his services to the Hawaiian Malacological Society, Junior Shell Club, and other Hawaiian malacological projects

Vexillum (Costellaria) adamsianum new species

(Figs. 6-9)

1963 "Mitra agria Dall MS", J. Cate, The Veliger, vol. 6, no. 1, p. 36, pl. 7, fig. 32 (*nomen nudum*) - placed in synonymy of *Vexillum xenium* Pilsbry, 1921.

Description—Shell moderately small, 8.0-17.0 mm in length, elongate to elongate-ovate, some individuals broader than others, width 34-42% of length, protoconch conical-multispiral, consisting of 3¹/₂ glassy, white embryonic whorls, teleoconch consisting of 5¹/₂-7¹/₄ slightly convex mature whorls which are distinctly angulate at the sutures. Sculptured with angulate and usually straight axial ribs which number from 13-17 on the penultimate and from 13-21 on the body whorl; spiral sculpture consists of distinct, low spiral cords which ascend the walls of the axial ribs and usually notch their summits, cords number from 5-7 on the penultimate and from 8-12 on the body whorl, siphonal fasciole with 2 or 3 nodulose, oblique cords. Aperture slightly shorter or longer than the spire, 44-55% of length, lirate within, outer lip weakly convex, columella not calloused and with 4 or 5 (usually 4) oblique folds which decrease in size anteriorly. Variable in colour but usually white and sparsely or densely ornamented with dark reddish brown or purple-brown areas of varying intensity and usually appearing as quadrate or rectangular blotches arranged in two broad bands on the body whorl and a single band on the spire whorls; the white central band is with or without an interrupted reddish brown spirial line, aperture rose-purple to violet-purple.



FIGS. 6-9. *Vexillum (Costellaria) adamsianum* new species. Keehi Lagoon, Oahu, Hawaiian Ids. 6. Holotype, length 13.7 mm. 7. Paratype, length 11.3 mm. 8. Paratype, length 16.8 mm. 9. Paratype—subadult, length 9.0 mm.

Measurements (mm)

	length	width
Holotype (AIM/TM-1354)	13.7	4.7
Paratypes:		
No. 1 (col. A. Adams)	16.8	6.1
No. 2 (USNM 173197)	10.2	4.3
No. 3 (USNM 338182)	10.0	3.8
No. 4 (DMNH)	9.0	3.7

Material—HOLOTYPE: Keehi Lagoon, Oahu, Hawaiian Islands, 50 fathoms; AIM/TM-1354. PARATYPES: No. 1—same data as the holotype; coll. A. Adams. No. 2—St. 3846, south coast of Molokai Id., H.I., 60-64 fathoms at 71.5° F; USNM 173197. No. 3—reef near Honolulu, Oahu, H.I.; USNM 338182. No. 4—same data as the holotype: DMNH. Paratypes No. 5-14 from Keehi Lagoon, Oahu, H.I., 125 fathoms, from Makaha Beach, Oahu, H.I., 40 fathoms, and from Pokai Bay, Oahu, H.I., 40-100 fathoms, are in the B. P. Bishop Museum, Honolulu, AIM, coll. A. Adams and coll. R. Salisbury. Specimens from Hitiaa, Tahiti, French Polynesia, are in coll. J. Trondle and AIM.

Range—Various stations in the Hawaiian Islands, 40-125 fathoms, in *Pinna* beds or sand and coral-rubble. Also occurs at Hitiaa, Tahiti, 10-12 m.

Remarks—The first three specimens of the new species were taken many years ago by the U. S. Fish Commission in the Hawaiian Islands and a single specimen was found by D. Thaanum on a reef near Honolulu. The late W. H. Dall marked these specimens "*Mitra agria* Dall" on labels in the National Museum of Natural History, Washington, clearly recognizing the taxon as new to science. The name has never been published and remained a manuscript name. J. Cate (1963) in a revision of Dall's Hawaiian Mitridae, published the name "*Mitra agria*" as a *nomen nudum*, and considered the species to be a juvenile stage of *Vexillum (Costellaria) xenium* Pilsbry, 1921. Dall's specimens, however, are conspecific with *V. (C.) adamsianum* and have been included in the type-series of this species.

V. (C.) adamsianum is superficially similar to *V. (C.) wolfei* but differs in its larger size, distinctly angulate whorls, coarser sculpture, colour, and absence of a sutural row or nodules and the translucent golden sheen. In some younger specimens of *V. (C.) adamsianum* the axial ribs protrude slightly above the suture and giving them a hooked appearance.

The species is named for Mr. Andrew C. Adams, Aiea, Hawaii, in recognition of his sub-

tidal dredging efforts in the Hawaiian Islands which brought to light specimens of the new species.

After the manuscript and plates were completed, we have received 2 specimens of *V. (C.) adamsianum* from Hitiaa, Tahiti, which were collected by Mr. J. Trondle from Papeete. Although collected in only 10-12 metres, the specimens are undoubtedly *V. (C.) adamsianum*.

Family Turridae

Subfamily Mitromorphinae Casey, 1904

Mitrolumna salisburyi new species

(Figs. 10-12)

Description—Shell minute 3.0-4.0 mm in length, ovate-biconic, width 47-50% of length, shining, sutures barely distinguishable and only indicated by a slightly deeper sutural trough on which are superimposed short axial riblets connecting the two sutural rows of nodules: protoconch conical-multispiral, consisting of 3½ smooth, glossy, golden-brown embryonic whorls, teleoconch consisting of 4¼-4½ mature convex

whorls. Sculpture on first one-half of the post-embryonic whorls consists of 3 or 4 spiral rows of small, regular nodules, subsequent whorls with 3 rows of nodules, penultimate whorl with 4 rows of nodules, the two central rows partly fused together and forming short axial ribs which number from 24-26, body whorl with 7 or 8 spiral rows of moderately large nodules, followed by 6 or 7 oblique cords which commence in line with the first columellar fold, first 3 or 4 posterior cords nodulose, last 3 cords fairly smooth. Aperture about the same height as the spire, narrow, shortly lirate within, constricted posteriorly by a prominent callosity which sometimes consists of two fused denticles, turrid sinus moderately distinct but not deep, columella centrally with a "V"-shaped fissure which produces 2 prominently swollen cords, posterior cord slightly larger than anterior one, siphonal canal spout-shaped. Base colour orange-brown, both posterior and anterior row of sutural nodules rosy-mauve, nodules anteriorly to the body whorl suture white, followed by a rosy-mauve peripheral band extending over 2 rows of nodules and another rosy-mauve basal band extending over the first 3 oblique cords on the siphonal fasciole; aperture rosy-mauve, callus on outer lip pale rose or whitish.

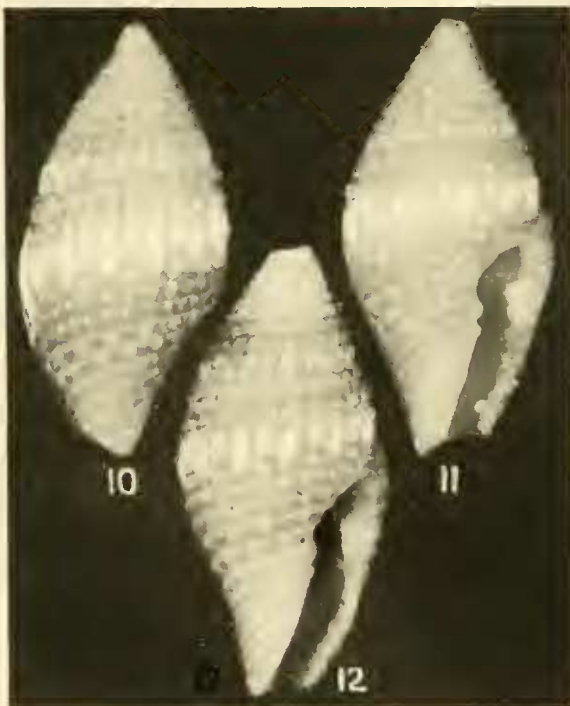
Measurements (mm)

	length	width
Holotype (AIM/TM-1349)	4.0	2.0
Paratypes:		
No. 1 (AIM)	4.2	2.0
No. 2 (DMNH 112101)	3.9	1.9

Material—HOLOTYPE and type locality: Maile Point, Oahu, Hawaiian Ids., at base of cliff, 32 fathoms (*leg.* R. Salisbury, 22-V-1976); AIM/TM-1349. PARATYPES: No. 1—same data as the holotype; AIM. No. 2—same data as the holotype; DMNH 112101. No.'s 3-5—in coll. R. Salisbury, Honolulu, from the type-locality.

Range—Known only from Maile Point, Oahu, Hawaiian Ids., in 32 fathoms.

Remarks—This is the second known species of *Mitrolumna* from the tropical Indo-West Pacific, the other being *M. stephensi* (Melvill & Standen, 1897). The Indo-Pacific *Mitromorpha lachryma* (Reeve, 1845) and *M. (Lovellona) atramentosa* (Reeve, 1849), and the Hawaiian *M. peaseana* Finlay, 1927 (= *Conus fusiformis* Pease, 1861 =



FIGS. 10-12. *Mitrolumna salisburyi* new species. 10., 11 Holotype, length 4.0 mm. 12. Paratype, length 4.2 mm.

C. parvus Pease, 1868, both homonyms), also belong to the subfamily Mitromorphinae, but should be assigned to *Mitromorpha* Carpenter, since all 3 species lack the biplicate columella which is a characteristic feature of *Mitrolumna*.

Mitrolumna stepheni (M. & St.), is similar to *M. salisburyi*, but is more elongate, the axial ribs are more angulate, wider-spaced and better developed, and the axial sculpture terminates on the body whorl at the periphery where it is replaced by flattish, smooth spiral cords which commence in line with the sinus. In *M. salisburyi* the whole body whorl is nodulose with the exception of the last 3 anterior cords, and the oblique spiral cords commence in line with the first columellar fold. There are only 15-16 axial riblets on the penultimate whorl in *M. stepheni* but 24-26 in *M. salisburyi*. *M. stepheni* is coloured quite differently, being white to yellowish-fawn, ornamented with a single row of wide-spaced, dark brown spots on the penultimate whorl suture, and the dorsal side of the body whorl has a large, dilacerated, dark orange-brown blotch which intrudes partly between the interspaces of the axial ribs. *M. stepheni* also has 3½-4 conical embryonic whorls, but they are milky-white in colour and not glassy golden-brown.

Although other species of *Mitrolumna* have 1½-2½ dome-shaped embryonic whorls, *M.*

stepheni and *M. salisburyi* have a protoconch of 3½-4 conical embryonic whorls, and the Galapagan *M. keenae* Emerson & Radwin, 1969, a protoconch of 3¼ whorls. The same diversity of protoconch features exists in other genera of Turridae, and a further subdivision of *Mitrolumna* on this basis alone is not warranted.

The new species is named for Mr. R. Salisbury, Honolulu, in recognition for his extensive field-work in the Pacific, resulting in the discovery of several new species.

ACKNOWLEDGMENTS

I would like to express my thanks to Dr. H. A. Rehder, National Museum of Natural History, Washington, for the loan of Dall's mitrid specimens, and to Mr. R. Salisbury, Honolulu, Mr. B. Parkinson, Rabaul, and Mr. J. Trondle, Papeete, Tahiti, for the loan of specimens.

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MEASUREMENTS OF VELOCITY FROM EXCURRENT SIPHONS OF FRESHWATER CLAMS¹

Richard E. Price and Frank R. Schiebe²

ABSTRACT

In the study of trace metal accumulation and food web relationships of plankton and clams, it is important to know the volume of water passing through a clam. Water velocities from the excurrent siphon of Anodonta sp. were measured using a hot-film anemometer and hydraulic procedures. Clam siphons were measured and volumes of water pumped were calculated. Pumping velocities for individuals, regardless of size, were nearly constant. The volume of water passing through clams was correlated with their sizes.

¹ Contribution from the Department of Biology, University of Mississippi in cooperation with the U. S. Sedimentation Laboratory, Agricultural Research Service, Oxford, Mississippi-pi 38655.

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